Name:____ Date:____________________

Polynomial Operations SOLUTION (version 214)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -8x^5 - 10x^4 + 6x^3 - 3x - 9$$

$$q(x) = 4x^5 + 10x^3 - 8x^2 + 7x - 1$$

Express the difference $q(x) - p(x)$ in standard form.

Get "unsimplified" forms. Then find $q(x) - p(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (-8)x^5 + (-10)x^4 + (6)x^3 + (0)x^2 + (-3)x^1 + (-9)x^0 \\ q(x) &= (4)x^5 + (0)x^4 + (10)x^3 + (-8)x^2 + (7)x^1 + (-1)x^0 \\ q(x) - p(x) &= (12)x^5 + (10)x^4 + (4)x^3 + (-8)x^2 + (10)x^1 + (8)x^0 \\ q(x) - p(x) &= 12x^5 + 10x^4 + 4x^3 - 8x^2 + 10x + 8 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = -2x^2 + 5x + 8$$

$$b(x) = -4x + 8$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-2x^2$	$5x$	8
$-4x$	$8x^3$	$-20x^2$	$-32x$
8	$-16x^2$	$40x$	64

$$a(x) \cdot b(x) = 8x^3 - 20x^2 - 16x^2 - 32x + 40x + 64$$

Combine like terms.

$$a(x) \cdot b(x) = 8x^3 - 36x^2 + 8x + 64$$

3. Express $(x+1)^4$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^4 + 4x^3 + 6x^2 + 4x + 1$$

Polynomial Operations SOLUTION (version 214)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 7x^3 - 22x^2 - 27x + 5 \\ g(x) &= x - 4 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x-4}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

	7	-22	-27	5
4		28	24	-12
	7	6	-3	-7

So,

$$\frac{f(x)}{g(x)} = 7x^2 + 6x - 3 + \frac{-7}{x-4}$$

In other words, $h(x) = 7x^2 + 6x - 3$ and the remainder is $R = -7$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 7x^3 - 22x^2 - 27x + 5$. Evaluate $f(4)$.

You could do this the hard way.

$$\begin{aligned} f(4) &= (7)\cdot(4)^3 \ + \ (-22)\cdot(4)^2 \ + \ (-27)\cdot(4) \ + \ (5) \\ &= (7)\cdot(64) \ + \ (-22)\cdot(16) \ + \ (-27)\cdot(4) \ + \ (5) \\ &= (448) \ + \ (-352) \ + \ (-108) \ + \ (5) \\ &= -7 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(4)$ equals the remainder when $f(x)$ is divided by $x - 4$. Thus, $f(4) = -7$.